TITLE: ROLE OF QUANTITATIVE CT IN COPD & ITS CORRELATION WITH PULMONARY FUNCTION TEST VALUES

AIM:

To assess the role of Quantitative CT in COPD & evaluate relationship between Quantitative CT(QCT) and spirometric measurements of disease severity in subjects with and without chronic obstructive pulmonary disease (COPD).

BACKGROUND:

The chronic airflow limitation characteristic of COPD is caused by a mixture of parenchymal destruction and small airways disease the relative contributions of which vary from person to person. Standard pulmonary function test results fail to determine the relative contribution of the two pathologic processes involved in COPD. QCT of the lung parenchyma uses accurate measures of lung density to generate histogram statistics of the lung to detect lower-density areas of the lung that correspond to emphysema on total lung capacity (TLC) scans and can also look at lower-density areas of the lung that correspond to air trapping on CT scans of the lung obtained at functional residual capacity (FRC) or residual volume(RV). Computed tomography can also quantitatively assess morphologic changes such as emphysema, hyperinflation, bronchial wall thickening & vascular pruning.

MATERIALS AND METHODS:

QCT of subjects were performed in 16 slice CT and evaluated using Lung Volumetry Software. Measures examined include emphysema, defined as the percentage of low-attenuation areas ≤ –950 HU on inspiratory CT, air trapping, defined as the percentage of low-attenuation areas ≤ –856 HU on expiratory CT, and the inner diameter, inner and outer areas, wall area of segmental airways. Correlations determined between spirometry and several QCT measures.

RESULTS:

- Progressively increasing LAA-950I (Low attenuation area in Inspiration <-950HU) and LAA856E (Low attenuation areas in Expiration <-856HU) were noted for increasing GOLD stage and COPD disease severity.
- Mean LAA-950I and LAA856E values progressively increased with increasing GOLD stage ($p < 0.005$).
- For air trapping, LAA-856E showed correlation for both FEV1 and FEV1/FVC ($r = –0.93$ and $–0.79$, respectively).
- Emphysema showed similar results, with LAA-950I showing correlation for FEV1 and FEV1/FVC ($r = –0.81$ and $–0.69$, respectively).
- Both TLC and FRC increase across GOLD stage.
- Measures of inner diameter, inner area, outer area and airway wall thickness showed good correlation to both FEV1 and FEV1/FVC for all subjects in the cohort.
- Measures of wall area showed poor correlation to both FEV1 (r -.01) and FEV1/FVC (r -.02)

CONCLUSION

QCT measurements of inspiratory and expiratory low-attenuation areas are strongly associated with spirometric impairment in COPD patients.

KEYWORDS: COPD, Quantitative CT, Pulmonary function test, emphysema, chronic bronchitis, air-trapping, low attenuation areas.